R
Investigative Program
Intermountain Region

REPORT OF THE

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

AND

REGIONAL INVESTIGATIVE COMMITTEE

INTERMOUNTAIN REGION

1930-1931

CONTENTS

Page

Regional Investigative Committee Meeting..... 1

PART I. Annual Report of the Intermountain Forest and Range Experiment Station..... 3
Establishment of the Intermountain Station..... 3
Station Personnel..... 5
Station Program..... 6
Progress During 1930 and Plans for 1931..... 10
Forest Management..... 10
Erosion and Streamflow Investigations..... 11
Range Investigations - Great Basin Branch..... 14
Spring-Fall and Semidesert Winter Range Studies..... 19
Biological Studies..... 25
Progress with Publications During the Year..... 36

PART II. Experimental Forests and Natural Areas..... 39

PART III. Administrative Section..... 41
First Report of Liaison Committee..... 41
Forest Management..... 41
Range Management..... 43
Progress in Administrative Projects 1930..... 48
Forest Management..... 48
Range Management..... 51
Operation..... 52

Regional Investigative Committee Meeting

The regular annual meeting of the Regional Investigative Committee of the Forest Service to consider the progress during the past year and plans for the ensuing year in forest and range research in the Intermountain Region was held in Ogden, Utah, on January 30 and 31, 1931. At this meeting there was reported and discussed progress and plans of the Intermountain Forest and Range Experiment Station, and of the various investigative projects being carried on by the regional administrative organizations of the Forest Service. In addition to the personnel of the Intermountain Station, the Regional Office of the Forest Service, and one or more Forest Supervisors, representatives of cooperating agencies, the state experiment stations in the region, the livestock and forest industries, water users and other interested people were invited to attend and take part in the discussions. Although research work by the Forest Service is chiefly dealt with at these meetings, the broad scope of the activities cause them to be of wide public interest.

This report reviews briefly the different projects presented and discussed at the meeting and embodies the annual report of the Intermountain Forest and Range Experiment Station, as well as the report on projects being handled by the administrative organizations.

Attendance at the Investigative Committee Meeting

Regional Office:

R. H. Rutledge - Regional Forester
C. B. Morse - Forest Management
E. C. Sanford - Forest Management
Ernest Winkler - Range Management
A. R. Standing - Range Management
C. N. Woods - Operation
Dana Parkinson - Public Relations
R. E. Gery - Lands

Intermountain Forest & Range Experiment Station:

C. L. Forsling
L. F. Watts
George Stewart
E. W. Nelson
G. W. Craddock
G. D. Pickford

Utah State Agricultural College:

P. V. Cardon	-	Dir. Utah State Exp. Station
T. G. Taylor	-	Professor of Forestry
R. J. Becraft	-	Professor of Range Management
C. M. Genaux	-	Extension Forester
R. W. Bailey	-	Professor of Geology
G. D. Clyde	-	Professor of Irrigation
Wm. Peterson	-	Director of Extension

Other Representatives:

Geo. Collard	-	Pres., Utah Wool Growers Ass'n.
J. M. Macfarlane	-	Pres., Utah Cattle & Horse Growers Ass'n.
Dr. Geo. R. Hill, Jr.	-	American Smelting & Refining Co.

PART I

ANNUAL REPORT OF THE

INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION

Since this report marks the beginning of a new series coincident with the establishment of the Intermountain Forest and Range Experiment Station, a brief review of past research work in the region is presented.

Research in forestry and related problems, which is one of the three primary functions of the Forest Service, had its inception in the Intermountain Region with the organization of the regional office in 1910. For about ten years after that date there were several men working on silvicultural problems in the region but funds for special research were withdrawn about 1919 for better handling of the work in other regions. It was early recognized that range and watershed problems were of special importance and in 1912 the Great Basin Experiment Station was established with field activities concentrated at a field station on the Wasatch Plateau near Ephraim, Utah. Work with small funds and few personnel has been carried on at that station ever since 1912. Although of limited scope, the silvicultural, range and watershed studies made much progress in laying the foundations for forestry and range management in the region. The Great Basin Experiment Station is the pioneer range experiment station in the United States and much of the present day progress in range management traces back to the work of this station.

The passage by Congress of the McSweeney-McNary Forest Research Act in May, 1928, has made possible the laying of broader plans for forest and range research more commensurate with the needs of the region. Subsequent increases in appropriations for the fiscal years ending June 30, 1930, and June 30, 1931, have made it possible to undertake the development of that program.

Establishment of the Intermountain Forest & Range Experiment Station

In line with the enlarged research program for the region the Secretary of Agriculture, early in July, 1930, formally established the Intermountain Forest and Range Experiment Station with headquarters at Ogden, Utah. This is in accordance with the plan of dividing the United States into twelve regions, each with conditions of climate, vegetation, soil and other features more or less peculiar unto itself. The Intermountain Station is the eleventh of twelve such stations to be established.

The Intermountain Region, which this station is to serve from the standpoint of federal participations in research in forest, range and watershed problems, comprises all of Utah, all of Nevada except a narrow

strip along the west border of the state, the portion of Idaho south of the Salmon River, of Wyoming west of the continental divide and of Arizona north of the Grand Canyon. This is an area of about 180,000,000 acres with a variety of conditions with respect to soil, climate, topography and vegetation. [1] With the exception of the high mountainous areas, the territory is more or less semidesert plateau with an elevation of from 3,000 to 6,500 feet above sea level. This has a semiarid climate with an annual precipitation from a little less than four to about fourteen inches. Livestock grazing is the principal land use. The remainder varies from foothills to high mountains reaching up to 10,000 feet or more in elevation with an annual precipitation from about 15" to 30" or more per annum. The high country is valuable for water supply, timber, grazing and other incidental uses. Continued occupation and development of the region rests primarily upon the protection, conservation and proper use of the watersheds and water supply, the range forage, the timber and recreational and other uses of the wild or uncultivated lands.

Branch Stations, Centers of Work and Laboratory Facilities

This regional experiment station as now being developed consists of a group of people working out of the official headquarters at Ogden, Utah, on selected problems in various parts of the region. Branch stations and centers of work will be established in various parts of the region for the study of specific problems as problems demand. The former Great Basin Experiment Station has been absorbed and becomes a branch station. The United States Sheep Experiment Station at Dubois, Idaho, has been used as a center of work on spring-fall range since 1924. A center of field work has been established for erosion and streamflow studies on the Boise River watershed in Idaho; this may later be developed into a branch station. Plans are under way for the selection of a western yellow pine experimental forest. The selection of a center of work for the desert range project will receive early attention. Laboratory facilities will be developed at the central headquarters as soon as resources will permit.

Cooperation

The success of the work of the station and the accomplishment of the purpose for which it has been established obviously will require the continuous support and interest of the public it is to serve and cooperation of the other research agencies of the region. Therefore, the policy has been established of receiving at every opportunity the suggestions from the interested public in planning and carrying on the program of work and of cooperating to the fullest extent possible with public and private organizations, groups or individuals including the

---

[1] A full discussion of the land use problem in this region was presented in the annual report of the Great Basin Experiment Station for the year 1928.

State Agricultural Experiment Stations, other federal bureaus and organizations of livestock growers, farmers, water users, etc. The public interest has been manifested by the helpful suggestions that already have been afforded by representatives of the various interests. It is believed, however, that for the sake of concerted and continuous help along this line it will be advisable to have designated by the Secretary of Agriculture an advisory research council made up of representatives of the various groups concerned.

Station Personnel

The personnel of the station at present is as follows:

C. L. Forsling	-	B. S., Principal Silviculturist, Director.
Walter E. Mann and Marguerite A. Israelson	-	Clerks.
_____	-	Statistical Clerk.
L. F. Watts	-	M. F., Senior Silviculturist, Assistant Director, in charge of Silvics.
C. A. Connaughton	-	B. S., Junior Forester, Assistant in Silvical Research.
George Stewart	-	Ph. D., Senior Forest Ecologist, in charge Spring-Fall and Winter Range Investigations.
E. W. Nelson	-	M. A., Associate Range Examiner, in charge Great Basin Branch Station.
G. W. Craddock, Jr.	-	M. F., Assistant Range Examiner, Spring-Fall and Summer Range Studies.
G. D. Pickford	-	B. S., Assistant Silviculturist, Spring-Fall and Winter Range Studies.
_____	-	Junior Range Examiner, Spring-Fall and Winter Range Studies.
F. G. Renner	-	B. S. F., Associate Range Examiner, Erosion and Streamflow Studies.
C. K. Pearse	-	B. S., Junior Range Examiner, Erosion and Streamflow Studies.
S. B. Locke	-	Associate Biologist, in charge Biological Investigations. (In cooperation with U. S. Biological Survey.)

Station Program

The present program of the Intermountain Station includes the continuation of a number of projects on high mountain summer range and one on spring-fall range that were already under way prior to the beginning of the enlarged program and several new projects that have been started during the past two years.

The older projects, some of which are being continued, are as follows:

Range Management

1. The artificial reseeding of depleted range lands: During the past fifteen or more years a great many species of cultivated and a few native range plants have been tried out under various conditions to test their suitability for range reseeding purposes. Results of the tests for the period up to 1929 will soon be available as a Department of Agriculture publication.

2. The natural revegetation of mountain ranges: This project includes a number of subdivisions dealing with plant successions, range rehabilitation, range maintenance, influence on productivity of range forage of time and frequency of harvesting, and degree of utilization under various conditions on high mountain range lands in central Utah. Various phases of this project have been completed and reported upon in Department of Agriculture Bulletins Nos. 791 and 1405. Other phases of the project are being continued.

3. Range readiness and the length of the grazing season on mountain grazing lands: The early work on this project has been reported upon in Department of Agriculture Bulletin 1405. The study of variation in plant development one year with another on various exposures and at different altitudes is being continued and field work will be completed in another season.

4. The effect of climate on plant growth: This is a project to study the influence of season to season variation in climate on the range forage crop as a basis for range management to meet this disturbing factor in range use. An early phase has been reported on in Department of Agriculture Bulletin No. 700. Detailed investigations are now being carried on to effect a basis for the interpretation of long time weather records of the Weather Bureau.

5. The effect of grazing on herbaceous plant cover in relation to erosion and streamflow: This is a long time study of the role of herbaceous vegetation in the control of erosion and the regulation of streamflow on a high mountain watershed in central Utah. Early results were published in Department of Agriculture Bulletin 675. A report summarizing fifteen years' records of precipitation run-off and erosion under two degrees of plant cover and soil conditions will be published shortly.

6. Planting to check erosion: This study of species and methods to use in planting to check erosion on eroding mountain range lands has been concluded and results are being published in the artificial reseeding bulletin.

7. The management of browse range: This study which has been completed was to determine the value and satisfactory degree of use of certain types of browse range for summer grazing by cattle. The results and conclusions have been published in Department of Agriculture Circular No. 62.

8. The study of the characteristics of the cell sap of range plants: This is a study to determine if the sap of range plant species have any fixed characteristics which will determine the relationship of the species to the habitat, their value as range plants, etc. Several years' records were obtained in cooperation with the late Dr. J. Arthur Harris of the University of Minnesota and are to be analyzed during the next year.

9. The effect of grazing on aspen reproduction: Study completed and results published in Department of Agriculture Bulletin 741.

10. The management of sagebrush - blue bunch wheatgrass range for spring and fall grazing: This project deals with a number of phases of the spring-fall range type in east central Idaho. Up to the present time attention has been devoted chiefly to the method, time and degree of use early in the growing season, natural revegetation and maintenance of the range, the change in the plant cover under various grazing practices, the carrying capacity of the range and the climatic factor. A report for publication on the first seven years of the study is in course of preparation.

Forest Management

Projects under this classification include the (1) influence of grazing on western yellow pine reproduction, published in Department of Agriculture Bulletin No. 738; (2) the growth requirements, reproduction, growth, yield, uses, management, etc. of aspen, published in Department of Agriculture Bulletin 1291; (3) the initiation of a small study of methods of cutting and growth of virgin stands of western yellow pine, early results published in J.A.R. Vol. XXVIII, No. 11; (4) forest planting including selection of site, etc., results published in Department of Agriculture Bulletin 1264 and in another bulletin now in course of publication; (5) limited studies of site, growth and yield, and for the preparation of volume tables, the results of which have been used locally.

Projects which have been undertaken during the past two years are as follows:

Range Management

1. The role of seed production and germination and establishment of seedlings in range revegetation: A large number of range plants on the Wasatch Plateau in central Utah have been studied and seed germination tests made. A report is in course of preparation.

2. The rehabilitation of foothill spring-fall range: A study to determine the present condition of the available spring-fall range area in Utah and portions of adjacent states and some of the possibilities of restoring the grazing capacity of these lands.

3. The management of semidesert winter range lands: A study to determine the grazing value of the vegetation, the present degree of productivity and possibilities for improving the grazing capacity of semidesert range lands.

Erosion and Streamflow

An intensive survey and analysis of existing conditions and available data on the factors influencing erosion and run-off on the Boise River watershed in Idaho. This is a watershed furnishing water for an important irrigation project. Excessive erosion has started causing the deposition of silt in storage reservoirs, in the main streams and in irrigation canals, and the depleting of the soil on the watershed itself. Stream measurements indicate on the average a progressively decreasing and earlier streamflow, which is detrimental to irrigation.

Forest Management

Methods of cutting western yellow pine: Western yellow pine is the most valuable saw timber species of the region. It is confined chiefly to granitic soils. The project aims to determine economical methods of cutting most desirable from the standpoint of maximum yield of timber and water.

Biological Investigations (in cooperation with the Biological Survey):

1. The role of rodents, especially pocket gophers in erosion on granite soil in Idaho. Large areas of eroding land are infested with pocket gophers and ground squirrels. The study is aimed to determine the influence of these rodents on the plant cover as it influences run-off and erosion and the direct influence of the work of pocket gophers on erosion.

2. The role of rodents, especially pocket gophers, ground squirrels, chipmunks, mice and rabbits in natural revegetation and artificial reseeding: Comparisons will be made of rodent free areas with

rodent infested areas on mountain ranges at the Great Basin Branch Station in plant types where rodents are thought to be a serious menace to reestablishment of vegetation.

3. The management of big game: Basic information is being collected on the forage requirements, life habits, etc. of (a) deer on their winter range in central Idaho where there is practically no grazing except by deer and other game, and (b) yearlong deer grazing on the Kaibab Plateau where there is heavy concentration of deer. There are also being planned studies of game management involving deer on range for which there is also a heavy demand for grazing during late spring, summer and early fall by domestic livestock in central Utah.

Progress During 1930 and Plans for 1931

Here follows a brief resumé of the progress made during 1930 in the various projects of the Intermountain Forest and Range Experiment Station and plans for each for 1931:

Forest Management (Silvical) Research

Silvicultural investigations by the Intermountain Station were provided for by an initial appropriation of $10,000 for the fiscal year 1931. The work to date has consisted of the preliminary survey necessary to organize a method of cutting study in western yellow pine in central Idaho, together with substantial progress in a statistical analysis of past fires in the region. Progress may be briefly presented as follows:

1. All methods of cutting plots in western yellow pine in Idaho have been critically examined. This includes four Mc (methods of cutting) plots established in 1909 to 1913 which have been remeasured twice are scheduled for third remeasurement in 1931, and 15 Mc plots established as administrative studies plots during the past five years. With a limited amount of additional work these plots will give a fair start on the method of cutting project.

2. Eighty acres of virgin uncut western yellow pine plots which were established in 1913 and remeasured in 1918 were examined with a view to remeasurement in 1931.

3. Much time was devoted to an examination of private and Forest Service cut-over lands. Private cut-over lands were found to be in much better condition than was anticipated. Only a relatively small part can be classed as unproductive land. Unfortunately, the worst areas are along traveled routes. Naturally only a small fraction of the cut-over area will provide a worth while second cut short of nearly a complete rotation. Much is seriously understocked yet the area as a whole is producing a considerable amount of timber. Brush disposal by piling and burning on private land is uniformly poor. Excessive damage to young growth has resulted from improper selection of the time to burn. Many old cut-over areas offer excellent opportunities for the location of yield plots in even-aged stands.

4. Several possible Experimental Forest sites were investigated. All except two areas were eliminated for one cause or another. Final selection of the best area should be made during 1931.

5. The statistical analysis of past fires is a cooperative project with Region 4. The Station is directing and supervising the work while the Regional Office is providing the man-power for abstracting and coding the fire report data. The project has been limited to the

eight so-called fire forests and to the period 1921-30. Abstracting and coding of the 3,500 fires included has been completed except for a few items which will require field conference for correct determination. The data will be put on punch cards and analyzed by the Station personnel next winter.

Work planned for 1931 consists of the following:

1. Third remeasurement of four Mc plots laid out from 1909 to 1910; analysis of the data and preparation of manuscript.

2. Second remeasurement of eight acres of virgin uncut western yellow pine plots, analysis of data and preparation of manuscript.

3. Establishment of one series of Mc plots in western yellow pine on the Payette National Forest and part of an additional series on the Weiser Forest.

4. Final selection of Experimental Forest.

5. Analysis of coded fire statistics and preparation of manuscript.

6. Any surplus field time will be spent on an intensive timber survey of the Experimental Forest.

Erosion and Streamflow Investigations

Boise River Watershed (Granite Soils)

A study of the factors influencing erosion and streamflow on the main watersheds having loose granite soils of southwest Idaho was started in July, 1929. The work has been confined almost entirely to the Boise River watershed, which has plant cover, topography and soil typical of a large province in Idaho.

Activities in this project have consisted of studies and surveys preliminary to the beginning of intensive studies of various phases of the problem.

(a) Climate and Streamflow

An analysis of more than sixty years' records of climate for the Boise, Idaho, Weather Bureau Station and of thirty-four years of records of streamflow of the Boise River indicated the following: Winter precipitation and spring temperatures are the major factors in determining the amount and time of surface run-off. A warm early spring will yield a quicker run-off and probably more water from a given amount of snow than a cold late spring but there is a greater

waste of water in the early warm spring due to so much unusable water going past the diversion dams before or during the early part of the irrigation season. It is apparent from the record that woody and herbaceous cover and the degree of establishment of gullies on the watershed exert an influence on the amount and time of run-off but exact measurement of the effect of these factors must await more intensive studies.

But very little erosion was caused by melted snow run-off during 1930. The weather during the melting period was moderate most of the time and melting occurred so slowly that there was but little surface run-off directly from the snow. One brief period high temperature late in the season caused faster melting and some erosion at the higher elevations. The main streams were barely turbid during the spring of 1930. Local people reported the streams far less turbid than average. Several local torrential rains caused heavy erosion on parts of the watershed during the summer. As the result of these rains the South Fork of the Boise River ran turbid for a period of ten days during the summer.

(b) Range-Erosion Survey

An intensive range-erosion survey of the Boise River watershed is under way as a joint Regional and Experiment Station project. To date 371,000 acres have been examined. This data is now undergoing analysis and should be helpful in establishing the relationship of the kind and degree of vegetative cover, the character of the soil, rodent population and other factors to the degree of erosion.

(c) Soil Analysis

Detailed observations have been made of the soil in many places and more than 100 samples have been taken on areas covering, in a general way, the range of present soil conditions on the Boise River watershed. The detailed observations show that much of the rich layer of top soil over a large part of the watershed has disappeared. It is yet to be determined to what degree this is a result of water erosion due to depletion of the plant cover and of gravitational creep caused by trampling by livestock. The samples are being subjected to chemical and mechanical analysis to determine the textural changes, losses of important ingredients, and change in water-holding capacity.

(d) Snow Storage and Melting Studies

Six snow survey courses have been laid out at elevations varying from 4,500' to 7,800'. Information as to the water yield from each elevation zone and also the per cent of water stored in the snow which

reaches the stream gauge will be ascertained. It appears from the 1930 data that the gauged water yield from the watershed is approximately 60 per cent of the water in snow storage on April 1. This is exceptionally high.

A series of plots were established, prior to snow melting in the spring of 1930, to study the effect of shrub cover and timber cover on snow storage and on the rate of melting. The study will be continued for several years. The 1930 measurements indicate that mature and overmature timber is wasteful of snow. Storage on brush and reproduction plots was materially larger than on the mature timber plots. A new set of plots including barren ground and covers of sagebrush, timber reproduction, mature timber with no understory and mature timber with a heavy growth of reproduction, were established in 1930 for observations during the spring of 1931.

(e) Natural Revegetation

A series of grazing exclosures with open check plots have been established to determine the rate of rehabilitation of native vegetation on depleted bunchgrass lands under protection against grazing, and under limited grazing, and to determine the rate and extent of control of erosion by natural revegetation.

Plans

Most of the preliminary work on this project has been completed and the work will be expanded and refined as fast as facilities will permit. Funds available for the fiscal year beginning July 1, 1931, will make it possible to install equipment and instruments for the intensive study of several phases of the influence of herbaceous cover, grazing, and past erosion on surface run-off, erosion and disposal of the precipitation.

The detailed analysis of the range erosion data for 371,000 acres and the critical analysis of over 100 soil samples should afford a basis for the publication of a progress report on each of these two phases.

The series of profile and surface elevation plots established in 1929 will be remeasured in 1931 to ascertain change in gully profiles and erosion deposits.

Erosion and Streamflow Studies on Clay Soils

During 1930 measurement of precipitation and summer run-off and erosion from the plots was made at the Great Basin Branch on a high mountain watershed having heavy clay soil and grass and weed cover for

the sixteenth successive season. The results of the previous fifteen years of study have been compiled and are being published. Observations will be continued.

Summer Floods from Torrential Rains

As much time as could be spared was devoted to a study of the cause of severe floods and mud flows which occurred in localities throughout Utah and adjacent territory during the summer of 1930. Sudden heavy rainfall such as may occur in a given locality at intervals of several years to perhaps several decades on barren or semibarren watersheds caused the floods. Floods occurred (1) where there was natural barrenness on portions of watershed due to extensive rock outcrop; (2) on semidesert areas where there naturally is a thin cover of vegetation due to an annual precipitation too low to support much plant cover; and (3) where a fairly dense cover on the watershed had been depleted in spots by overgrazing and fire. The most destructive floods occurred under the latter circumstance.

Important geological discoveries were made which show that in places where there was a heavy cover of natural vegetation on the watersheds prior to white occupation, floods similar to those of 1923 and 1930 were unknown. The evidence shows that vegetation is an important controlling factor in erosion and floods from sudden downpours of rainfall on high mountain watersheds in the Intermountain Region. The Station took prominent part in the study of this problem through the designation of the Director as a member of a special Flood Commission appointed by Governor George H. Dern. Forsling was chairman of the committee on Causes and Prevention. A report was prepared and published as Circular 92 of the Agricultural Experiment Station, Utah State Agricultural College.

Plans

Additional funds provided for the fiscal year beginning July 1, 1931, will make possible a further study of erosion and run-off as influenced by plant cover in the districts flooded in 1930, and for a survey of the erosion problem on forest and range lands on the Colorado River drainage in Utah.

Range Investigations at the Great Basin Branch Station

Climate and Plant Growth

The past season reflects the importance of the distribution as well as the amount of precipitation during the growing season on the range forage crop. The total precipitation for the growing season was above average but much of it fell too late to produce maximum benefits. The vegetation was reaching maturity when heavy rains came in August. The forage yield in 1930 was approximately 24 per cent below the seven-year average.

The results of seven years' observations in this study are being compiled and analyzed.

Natural Revegetation

Records of plant succession on high summer ranges beginning in 1915, which at that time were badly depleted but since have been protected from grazing, show rather strikingly the relationship between the rate of improvement of the vegetative cover and the stage of soil depletion. The data are summarized in the following table:

Improvement of Vegetation on Mountain Soils from 1915 to 1929
On Ungrazed Range

	Badly Depleted Soil			Medium Depleted Soil			Best Soil
	Year			Year			Year
	1915	1921	1929	1915	1921	1929	1929
Species Total (Number)	5	26	29	7	30	24	18
Grasses	0	3	5	3	8	5	5
Weeds	5	23	24	4	22	19	12
Perennial	2	15	18	4	16	14	11
Annual	3	8	6	0	6	5	1
Browse							1
Density Total:	.133	.287	.295	.423	.450	.622	.649
Grasses	0	.002	.016	.058	.088	.122	.368
Weeds	.133	.285	.279	.365	.362	.500	.278
Perennial	.042	.215	.262	.365	.325	.305	.268
Annual	.091	.070	.017	0	.037	.195	.010
Browse							.003
Forage Factor:							
For Cattle	.022	.066	.082	.147	.155	.226	.397
For Sheep	.050	.113	.113	.200	.205	.290	.413
Carrying Capacity:							
Acres per cow per mo.	36.36	12.12	9.76	5.44	5.16	3.54	2.02
Acres per sheep per mo	6.00	2.65	2.65	1.50	1.46	1.03	0.72
% Increase	1915-21		1921-29	1915-21		1921-29	
Total Density	115.79		2.79	6.38		38.22	
Carrying Capacity							
Cows	200.00		24.18	5.43		45.76	
Sheep	126.41		None	2.74		14.17	

There was a great influx of species and a material increase in density between 1915 and 1921 on the badly depleted soil. The lack of more than a slight improvement from 1921 to 1929 is probably due to the inability of the eroded soil to support a much greater plant cover than in 1921. After fifteen years the vegetation is approximately half in density, one-fourth in carrying capacity, and decidedly "weedy" as compared to that on the best soil.

There was a large increase in number of species during the period 1915 to 1921 on the area with a medium depleted soil but only a slight increase in density and carrying capacity. From 1921 to 1929 there was a gradual increase in both plant density and grazing capacity. After fifteen years, however, the vegetation on medium depleted soil, while approximately equal in density, is inferior in quality and has only one-half to two-thirds the grazing capacity of range where the soil was not depleted by erosion.

All of the natural revegetation quadrats and major plots will be charted or listed during 1931, the regular biennial year for this work. In the fall of 1931 this project will be ready for a summarization of fifteen years' records of plant succession.

Plant Vigor Studies

The field work in a study to compare the influence of different frequencies, seasons, and degree of harvesting of important range species on a plot basis started in 1923, was completed in 1930. Similar trials on a pasture basis with sheep, begun in 1923, also were completed in 1930. The data will be analyzed during 1931. A similar study with three important shrubs started in 1928 is being continued.

Utilization

The season of 1930 was an "off year" in mapping quadrats and major plots in the utilization study. However, plots were grazed according to the different schedules. The project will be continued with no change in 1931; all quadrats and major plots will be remeasured during the season.

Period Study

Detailed records of plant development from the date of disappearance of snow to the cessation of growth in the fall have been obtained for six years for important selected plants under different conditions of exposure in the three higher growth zones of the locality. Records will be obtained for one additional year, after which this phase of the project will be terminated and the results published.

Artificial Reseeding

A number of sowings were made during 1930 in the spring range type to supplement previous tests. This included sowings of sweet clovers in cooperation with the Bureau of Plant Industry. The sowings, made during May, June and October, involved several methods of treatment and are summarized in the following table:

Species	Source of Seed	Number of Tests: Plantation 1: P	Plantation 1: G	Plantation 1: Total	Plantation 2	Nursery	Total
	Tame Species						
Grasses							
Agropyron cristatum	Dickinson, N. D.	5	2	7	4		11
" cristatum	Oak Zone - Manti N. F.	0	0	0	1		1
Bromus inermis	Salt Lake City, Utah	7	2	9	0		9
" inermis	Oak Zone - Manti N. F.	0	0	0	2		2
" inermis	Great Basin Sta. Nursery	0	0	0	1		1
Poa bulbosa	Medford, Ore.	0	0	0	1		1
Others							
White sweet clover	Denver, Colo.	2	1	3	0		3
Yellow sweet clover	Denver, Colo.	5	1	6	0		6
Yellow sweet clover	Oak Zone - Manti N. F.	0	0	0	1		1
Black Medick	Oak Zone - Manti N. F.	0	0	0	1		1
Total Tests of Tame Species		19	6	25	11		36
	Native Species						
Grasses							
Agropyron caninum	Cache N. F., Utah	0	0	0	1		1
Bromus sp.	Tahoe N. F. - Region 5	0	0	0	2		2
" polyanthus	Great Basin Sta. Nursery	2	1	3	0		3
" polyanthus	Oak Zone - Manti N. F.	0	0	0	1		1
" porteri	Oak Zone - Manti N. F.	0	0	0	2		2
" porteri	Ephraim Canyon - Manti N. F.	0	0	0	1		1
" pumpellianus	Leadville N. F., Colo.	0	0	0	1		1
Poa pratensis	Oak Zone - Manti N. F.	0	0	0	1		1
Total Tests of Native Species		2	1	3	9		12
" " " all Species		21	7	28	20		48

1. Tests sown in rabbit-proof fenced areas.

2. Tests sown on grazed range.

On eighteen areas from .12 acre to .33 acre in size, the seed was sown in plowed contour furrows three to four feet apart, then covered with a brush harrow. Six plantations averaging 2.1 acres each on grazed range were sown broadcast on the raw ground and then trampled in by sheep.

Results from previous sowings in the sagebrush zone, observed in 1930 areas, follows:

The yellow sweet clovers have done better than the white sweet clovers regardless of the method of soil treatment. The yellow variety produces good stands of vigorous plants, bloom ten to fourteen days earlier and mature seed up to 8,000 feet in elevation. The best stands were produced when sown in plowed contour furrows. Substantial foliage and height growth was made in spite of constant grazing by cattle and rodents. The white sweet clovers produced good stands when sown in plowed contour furrows when protected from grazing animals and rodents, but poor stands resulted in nearly every instance on grazed range.

Crested wheatgrass (Agropyron cristatum) so far has proved to be a vigorous, rapid growing and drought resistant grass, which starts growth early in the spring and remains green until late in the fall, and withstands heavy grazing remarkably well. It produces a good seed crop only when protected from grazing during the main growing period. It matures seed in sites up to 8,000 feet in elevation. The best stands were obtained when sown in plowed contour furrows on areas protected from grazing. Seed sown broadcast on the raw soil and then trampled, produced good stands of fairly vigorous plants.

Common brome (Bromus inermis) has given fair to good results in the oak zone. It starts growth early in the spring, spreads by creeping rootstocks and matures seed up to 8,000 feet in elevation.

Many-flowered brome (Bromus polyanthus), a native forage grass of the higher summer range, produces both good forage and seed crops on ungrazed range when sown in plowed contour furrows and the seed covered with a brush harrow in the oak brush zone. Very poor results were secured on range grazed throughout the trial, where the seed was sown broadcast on raw soil and then trampled in by sheep.

Rodent and Deer Damage

Rodents are proving a serious drawback to either artificial reseeding or natural revegetation in the oak zone. Chief among them are the black-tailed jack rabbit, grey ground squirrel, striped squirrel, chipmunk and pocket gopher. They graze many of the introduced species and destroy the seed stalks of both native and introduced grasses prior to ripening of the seed. Consistent poisoning has not proven entirely satisfactory although it is effective in some degree.

Deer concentrate on the various fenced artificial reseeding areas especially after the outside range feed has been utilized and graze the plots closely.

Plans

A few methods of treatment with several species will be repeated during 1931. Otherwise the activities in this project will consist chiefly of noting results from previous sowings. A rodent-proof nursery will be made available in 1931 and the influence of rodents will be studied in cooperation with the Station biologist.

Study of Seeding Habits

For the past three seasons Miss Sylvia Griswold, a graduate student of the University of Chicago, has been carrying on a study of the production and germination of seed of native vegetation in relation to plant succession. A great many of the seed germination tests have been carried on during the winter at the University of Chicago. Reports are now being compiled on the results of this work.

Cell Sap Studies

Data on the cell sap of important range plants, including osmotic pressure, electrical conductivity, ph, and more important chemical constituents have been obtained during the summers from 1924 until 1929 inclusive, to determine the relationship of these properties to habitat and plant succession and their significance in range management. Progress in this project has been delayed on account of the untimely death of Dr. J. Arthur Harris of the University of Minnesota. It is expected that as soon as final arrangements have been made regarding the handling of his unfinished work a statistical analysis will be made of this study.

Spring-Fall and Semidesert Winter Range Studies

Spring-Fall Range Studies - Idaho

Cooperative range studies have been conducted on the sagebrush wheatgrass type of spring-fall range of the U. S. Sheep Experiment Station in southeastern Idaho during the past seven years.

Grazing of the range in the fall only maintained the carrying capacity and improved the palatability of the vegetation. There was a slight decrease in density of sagebrush and an increase in grasses and palatable weeds. This system affords maximum opportunity for improvement of depleted ranges.

Grazing in the spring after vegetative readiness for ten days only, with complete use in the fall, likewise maintained a consistently

high carrying capacity. Changes in the composition and density of the forage cover under this system have been negligible.

Grazing continuously through the spring period after vegetative readiness and again in the fall appeared to be practical for the first four years of the experiment. The cumulative effect of intensive spring grazing plus adverse climate conditions, however, caused the productivity of this pasture to decline rapidly in the last three years to a point 60 per cent below its original carrying capacity.

Grazing continuously in the spring beginning with the inception of growth, whether for a three weeks' period only or for the entire spring season, profoundly influenced the carrying capacity as well as the composition of the vegetation in two other paddocks. A paddock subjected to only three weeks of early continuous grazing has declined 62 per cent while the pasture which was grazed during the entire spring period produced only 25 per cent of its original carrying capacity in the seventh year. The decline in carrying capacity was accompanied in both cases by a corresponding decrease in the density of the grasses and palatable weeds while the sagebrush increased in density in an amount equal to the decrease in the palatable forage.

A report covering the first seven years' results in this project is now being prepared.

The numerous dry years that have occurred since this project was started makes it advisable to continue the experiments as started until a period of years with better than average growing conditions have prevailed. The present project is being fortified with more detailed studies of the vegetation.

Investigations on Foothill Spring-Fall Range in Utah

Preliminary studies to ascertain the changes in cover which have occurred during the fifty to eighty years the range lands in this type have been used were begun in May, 1930. The ranges north of Great Salt Lake, in Box Elder and Davis Counties of Utah, have been examined in greatest detail thus far. The study of additional areas in the state will be continued during the field season of 1931.

Areas protected from both fire and grazing, such as unused portions of cemeteries, field corners, etc., are assumed in this study to represent the character of the original vegetative cover in this range type. Protected areas show that perennial grasses, principally Agropyron spicatum, A. inerme, and Poa sandbergii, originally constituted the chief forage species on these areas, now making up 68 per cent of the

total plant cover of approximately 0.40 density on protected areas. Downy brome (Bromus tectorum), the only important annual grass found, occupies but 0.7 per cent of the plant cover. Sagebrush makes up only 11 per cent of the total plant density.

The more pronounced effects of fire, grazing, and the combination of fire and grazing on the character and amount of the original vegetation are indicated by a comparison of burned ungrazed, grazed unburned, and grazed burned areas with unburned ungrazed range.

Burned ungrazed plots exhibit very little difference in the total density or grazing capacity of the vegetation as compared to the totally protected plots, but have a 32 per cent smaller density of perennial grasses, 84 per cent smaller density of sagebrush, and a materially greater density of annual grasses, the latter representing 22 per cent of the total vegetation on the burned ungrazed plots. Grazed unburned plots as compared to the totally protected plots exhibited only a slightly lower density but a 40 per cent smaller grazing capacity, a 62 per cent smaller density of perennial grasses, more than twice as much sagebrush and a materially larger density of annual grasses but still only two-thirds as much density of annual grasses as on the ungrazed burned range. The grazed burned range had a total density of vegetation only 75 per cent as great as the totally protected range, a 56 per cent smaller grazing capacity, an 84 per cent smaller density of perennial grasses, twice the density of poor perennial and annual weeds, 20 per cent as great a density of sagebrush, and a density of annual grasses 20 per cent higher than on the ungrazed burned plots.

Examination of areas in the south central part of the state where there is less available spring-fall range indicates the ranges in this section are even more depleted than in the northern part of the state. Fires, however, have been of little consequence. In this locality there is but a small amount of downy bromegrass and indications are that spring use of the range is so heavy as to prevent the ripening of seed and hence reproduction of this grass.

Plans for 1931 in this project are to continue the study of the comparison of present conditions of spring-fall range as compared to ranges long protected in the various localities throughout Utah and some of the adjacent states, and to select areas for intensive study.

Semidesert Winter Range Investigations

Funds for this project became available the fiscal year 1931 and work was started in the fall of 1930. Preliminary activities consist of a broad survey of the winter ranges with a view to locating typical areas for more intensive study. Data are being obtained from typical

sheep outfits which use the winter range to determine the more general practices followed at present. In view of the general nomadic system of using the winter range it is almost impossible to obtain any preliminary data on the carrying capacity of typical areas. One operator who controls his winter range by the lease of strategic sections claims that the carrying capacity of the range he uses over a period of years has averaged 5.33 acres per sheep for a grazing season of 195 days during the winter.

An effort is being made to locate areas of range which for one reason or another have not been grazed, for use in determining the original condition of the semidesert range and for comparison with the condition now prevailing on most of the range.

The owners of two groups of sheep with approximately 100,000 head in each group have been interviewed regarding their general setups with respect to spring-fall and winter range. Some of the data in these surveys are summarized in the following tables:

Comparison of Fountain Green and Heber City Sheep Feeding Operations

	Fountain Green	Heber City
Total number outfits	26	20
Total number outfits fed	20	20
No. years fed in past 5 (1926-1930)	0-1	1-5
Weighted mean number of seasons in which feeding was done	0.77 1/	3.80 1/
Total number sheep fed when fed at all	68,750	83,411
Av. no. sheep fed annually for 5-year period (1926-1930)	13,750	71,231
Total no. days in feeding season	68.2	87.6
Total amt. corn fed in one year (pounds)	1,192,142	2,016,622
Av. annual amt. corn fed (5-year period 1926-30)(pounds)	238,428	1,721,097
Corn fed per head daily when fed at all (pounds)	0.254	0.276
Av. amt. corn fed per head per day (1926-1930)(pounds)	0.051 2/	0.236 2/
Total number outfits practicing shipping	7	11
Total no. sheep shipped when shipped at all	28,550	40,400
No. sheep shipped per year - (av. for period 1926-1930)	23,350	24,300
Total no. miles shipped when shipped at all	728	1,190
No. miles shipped per year (av. for period 1926-1930)	481.0	639.6

1/ Mean of seasons fed weighted according to proportion of outfits fed and no. of seasons in which feeding was done - expressed by formula -

$$\frac{\text{No. outfits fed x no. years fed}}{\text{Total no. outfits x no. years in period}}$$

2/ $\frac{\text{Av. annual amt. corn fed (five-year period)}}{\text{Total no. sheep fed x feeding period (days)}}$

* * * * * * * *

Use and Deterioration of Public Domain Winter Ranges on "West" and "East" Deserts

Public Domain Use - Winter Range

	West	East
Total no. outfits	39	7
Users of public domain for winter range	39	7
Number who thought deterioration had taken place	37	6
Average years using public domain (years)	28.3	22.9
Range in years of use - lowest to highest (years)	15-55	12-28
Av. percentage deterioration since acquaintance (per cent).	30.0	46.4
Range of estimated deterioration of those who did " "	10-60	12-75
Number who estimated no deterioration	2	1
Years of acquaintance (years)	12,20	12

Comparison of Fountain Green and Heber City Sheep Grazing Operations

	Fountain Green	Heber City
Total number band units (winter range)	26	20
Total number sheep represented	93,750	92,281
Number of owners represented	42	41
Av. no. sheep per owner	2,232	2,251
Av. no. sheep per band (winter range)	3,606	4,614
Av. no. days trail winter to spring range (days)	19.2	7.4
Av. no. days on early spring range (in reality on trail) (days)	18.5	1.1
Av. no. days on lambing range (days)	47.1	55.3
Av. no. days trail, spring to summer range (days)	1.9	2.2
Av. no. days on summer range (days)	90.6	88.5
Av. no. days on fall range (days)	11.2	26.8
Av. no. days trail, fall range (includes trail from summer to fall range (days)	12.5	2.2
Av. no. days trail, fall to winter range (days)	13.1	11.3
Av. date on winter range	11/5	11/7
Av. no. of days on winter range (days)	151.0	170.0
Av. mileage summer to winter range (miles)	198.3	107.2
Av. total time spent on trail (days)	65.2	24.2
Av. lamb crop (per cent)	84.6	94.0
Av. wt. lambs sold (pounds)	68.4	74.4
Av. per cent of total sales (wool)	55.6	32.4
Av. per cent of total sales (sheep)	44.4	67.6
Av. lambing date	5/16	5/8
Av. date lambs cut out	10/2	9/19

These data indicate that the availability of spring-fall range is having a material influence on the character of sheep production.

The general surveys will be continued during 1932 and will include detailed description of the vegetation, soil conditions, etc., on representative range areas. Data on utilization will be obtained during the spring of 1931 as a basis for ascertaining the forage value of different desert range plants.

Efforts will be made to locate a typical area of range for setting aside as an experimental winter range for carrying on some of the more intensive studies. It is possible that this may be worked out in cooperation with the Utah State Experiment Station, to be used jointly for range studies by this Station and for certain animal husbandry investigations by the Utah station.

Biological Studies

An Associate Biologist was assigned to the Station on August 1, 1930. Mr. S. B. Locke, who has been closely connected with work of this character in Region 4 of the Forest Service, was transferred to the new position.

Rodent Relationships to Erosion

One of the first projects to receive attention is that of the role of rodents in erosion on the watersheds of the Boise River. A brief survey made in late July and early August indicated that any work for the 1930 season would have to be limited to gophers and chipmunks since the ground squirrels were already denned up. Plans were developed for the construction of fences which would make at least some of the study plots rodent-proof. A general survey of the small rodents on the South and Middle Forks of the Boise River by mapping was attempted but it was soon determined that other than the small chipmunks and pocket gophers, small rodents were not numerous enough to influence the situation.

Collections were made of gophers and chipmunks and their ectoparasites, and material preserved for studies of intestinal parasites. A new mite was found on the chipmunks.

An area on a heavily infested flat on Fall Creek of 0.9 acre yielded four gophers by trapping with possibly one animal left. This area contained 510 mounds thrown out since the snow left the spring before. A beginning was made in digging out and sketching gopher runs, particularly to indicate methods of undertaking this work. Arrangements are being made with Dr. Henderson of the Zoological Department, Utah State Agricultural College, to keep specimens in captivity and determine the food habits. One specimen on hand was turned over to him and was kept for some time, and data obtained on the food consumed.

The pocket gopher project will be continued and will include the study of other rodents such as ground squirrels and marmots. Effort will be made to determine the effect on erosion of destruction of the vegetation and of the mechanical disturbance of the soil by rodents. The latter applies particularly to gophers. Advice regarding the influence of soil types and conditions will be obtained from Dr. Stewart of the Station staff.

It will be desirable also to analyze physical evidence that can be interpreted into an index of the rodent population for use in making general surveys. Attention will be given primarily to the gophers since it will be undesirable to attempt to cover too broad a field.

It has become very evident at the Great Basin Branch Station that rodents greatly influence both natural and artificial revegetation. Rodent-proof fences will be constructed on sufficient plots this season to enable the influence of this factor to be isolated.

Any work with rodents will be developed in close cooperation with Mr. Murrary and Mr. Zimmerman, leaders of rodent control for the Biological Survey in Idaho and Utah respectively.

Middle Fork of Salmon River Game Studies

A study has been under way for three seasons including this year, of the use by big game of the winter ranges along the Middle Fork of the Salmon River in Idaho. The study and observations have been carried out by the forest ranger assigned to the Loon Creek district of the Challis National Forest. The Regional Office, and this year the Experiment Station, have assisted in developing the methods to be used in such studies and a definite cooperative study has been outlined. A field trip was made last fall to the Middle Fork by Director Forsling and Associate Biologist Locke in company with Regional Forester Rutledge and other forest officers. A tentative outline for the study was prepared and a copy is attached. Owing to the changes because of the newness of the problem, that will very probably be necessary as the study proceeds, it will be desirable to maintain a close contact with this project. The recent designation of the territory involved as a primitive area to be administered as a game and recreation ground adds importance to this project. Publications in prospect are a popular treatment of the primitive area in its relationship to big game and a report on the methods and results of the study.

Kaibab Deer Problems

As yet no specific project has been initiated here on the Kaibab by the Experiment Station, but the least that should be undertaken is a survey of the work now being carried on by the forest officers and any assistance possible to make this more effective. During the latter part

of March or early April, Forest Supervisor Mann and Associate Biologist Locke will review all the records and prepare a paper which will make available all information bearing on the management of the deer herd. Some of the points on which information must be obtained in field studies as a basis for adequate management are; when will reduction be adequate, what factors influence distribution and drift, what are the losses, what is the increase, and what is the actual carrying capacity of the various range types.

Forage Relationships of Game and Livestock

Deer and elk have increased on the National Forests of central Utah, where there is intensive demand for grazing of domestic livestock, until a study of the relationship of utilization of forage by game and domestic livestock is necessary. A general survey of the administrative phases of the problems is being undertaken by the Regional Office. It is planned that the Experiment Station will cooperate with them in detailed studies of forage habits of game and relationship of these to the forage habits of domestic stock.

Survey of Data Available

A survey of data on game such as that which has been outlined for the Kaibab deer could well be made of data pertaining to wild-life management problems in the region as a whole. There is much information scattered in game reports, etc. which needs to be accessible in compact form for analysis in connection with future work. This could well be a joint study with the Regional Office and should summarize wild-life conditions to the present time.

Antelope

Research on antelope is lower in priority than several other problems and none will be undertaken at present. However, action is needed to place the management and preservation of the antelope herd in the vicinity of the Lemhi National Forest on a sound basis. It will be desirable to give the local forest officers whatever assistance is possible in this connection.

Birds

It is desirable that as soon as some of the more pressing game problems have received attention, studies be initiated in determining the factors which influence the production of upland game birds on range lands both inside and outside the National Forests. There has been a decided reduction in the upland game birds and shooting alone does not seem to be the cause. This is particularly noticeable with the blue grouse. The U. S. Sheep Experiment Station near Dubois, Idaho, offers an excellent opportunity for a study of the relationship of sheep grazing

to sage grouse since these birds nest within the fenced paddocks grazed under different degrees of intensities. There is also a valuable and interesting field for research in the situation on Grey's River on the Wyoming National Forest in Wyoming, where the ruffed grouse are abundant. Nesting goshawks are unusually common but ground squirrels are rare.

Public Education

Game conferences have been held during the past two summers in Yellowstone National Park. These included representatives of the National Park Service, Regions 1, 2, and 4 of the Forest Service, the Bureau of Fisheries, Biological Survey, and sportsmen and representatives of game departments of the states of Montana, Wyoming, Idaho and Utah. These meetings bring out much discussion of the relationship of research to wild-life management. The key note of the meeting in August, of which Associate Biologist Locke was the chairman, was quite definitely "more science in wild-life management." Mr. Locke was continued as chairman for next year.

There are often calls for talks at sportsmens' meetings and it is believed that a definite and continuous project of education could be developed. This would require the collection of material bearing on wild-life relationships to forests and its preparation in a form desirable for presentation to game associations or other interested associations in lectures or by publications. Any application of proper principles of wild-life control and management is influenced by the public understanding of its desirability.

Publications

Owing to the newness of this field of research, there will not be much research material from recently organized projects for immediate publication. There should be, however, information in the nature of surveys or statements of research problems which might be valuable. There also will be brief discussions of methods as they are developed. During this season the information on the Kaibab deer herd should be ready for publication. Other publications that should be completed as soon as material is available are as follows:

1. Wild-life production on the Middle Fork of Salmon River Primitive Area.

2. Problems for Research in Wild-life Relationship in the Intermountain Region.

3. Methods of studying forage utilization by Game Animals.

TENTATIVE OUTLINE OF THE GAME MANAGEMENT STUDY ON THE MIDDLE FORK OF THE SALMON RIVER, CHALLIS, PAYETTE AND SALMON NATIONAL FORESTS.

Objective

To determine the proper utilization of the forage, the sustained carrying capacity of the range and other facts essential to the proper management of deer and other game animals on the Middle Fork of the Salmon River game range in Idaho.

The objective of this plan and study are based upon the following purposes in the administation of the land areas involved:

1. Conservation or maintenance on a fully sustained yield basis of the range or forage supply for game on the land allotted primarily to game range, in a manner consistent with the growing of timber and the protection of watershed values.

2. Maintenance of the stocking of game on the land involved within the full sustained capacity of the forage supply.

3. Provision for the proper control or removal of the game animals in excess of the carrying capacity of the range.

Status

The canyon of Middle Fork of the Salmon River from approximately the mouth of Marble Creek to the mouth of Wilson Creek and the lower adjacent part of the tributary drainages is used extensively as winter range for the deer which summer higher up on the Middle Fork drainage. Possibly some of the deer that summer in adjacent drainages migrate to the Middle Fork for the winter. A considerable number of mountain sheep and goats also are within the deer winter range. Observations during the past several years on the area have indicated that certain of the more choice forage species are being rather closely grazed and on local areas overgrazed and that possibly the range was approaching full stocking or overstocking with deer. Possibilities may be that the number of deer regularly dependent on this winter range have multiplied until they now approach the full capacity of the winter range, or that, due to new circumstances that may have arisen, deer from other areas which formerly did not come to the Middle Fork winter game range are now migrating to this area to winter. At any rate, as a guide for measures to regulate or control the number of animals that winter on the area, it will be necessary to know the influence that current use is having on the winter game forage, if the range is being maintained at its full productive capacity or if there is use to a degree that is depleting the forage supply.

There is but meager information available on such features as the grazing habits of deer, the degree of overgrazing and depletion of

plant species that may occur, the extent to which deer turn to other abundant species as the more choice species become depleted, the influence of close use of choice species on the condition of the deer and many other important points.

Information is needed also on the habits, life history, diseases, predatory enemies and other factors which affect the deer population and condition of the animals, all of which are important factors in game management.

Degree of utilization and its influence on the maintenance of the forage supply and the effect of winter concentration on utilization should receive the primary emphasis in the present study. Information on many other important points that may also be obtained should receive as much attention as time and facilities will permit.

Method of Study

Forage utilization

Systematic observations on degree of utilization should be made and recorded once a month on selected areas, preferably the areas where counts are made, including the "Deer Pasture" and the other intensive "count area" just below White Creek. The first observations should be made before the main drift to the winter range starts, probably in October. Intensive utlization data by measurements should be obtained once a month on a few selected plants on some one of the permanent sample plots or transects. In the spring a general utilization survey should be made over the main portion of the deer range extending up to the upper limit of winter range. These observations should be made by broad vegetative types, perhaps segregated by zones of elevation. The utilization should deal with all important species including bitterbrush, gray chrysothamnus, green chrysothamnus, mountain mahogany, ceanothus, Douglas fir, yellow pine, sagebrush, chokecherry, Oregon grape or other brush; all important weeds, blue bunch wheatgrass, fescue, bluegrass and other important grasses.

Current year's growth should be the basis of the measure of utilization. A study should be made by measuring the length of twig growth on a number of representative specimens of each species on open plots in the fall before grazing to ascertain the extent of growth during the previous summer. (See Nelson's paper on "Methods of Studying Shrubby Plants in Relation to Grazing.") The degree of utilization can then be related to the portion of the current year's growth that has been removed.

The following utilization classes should be used. For each class there is indicated the approximate portion of each year's growth of a species that has been taken for the species to fall in the respective classes.

Serious over-utilization	(over 100	per cent)
Extremely close	" (90-100	" ")
Close	" (70-90	" ")
Moderate	" (50-70	" ")
Light to moderate	" (30-50	" ")
Light	" (10-30	" ")
Very light	" (0-10	" ")
Not utilized	None	

This scheme may be used for designating the degree of utilization for a single plant, a group of plants, or all of the plants of a given species throughout a type or other unit. Utilization estimates always should be by individual species.

The examiner should "train his eye" and check his estimating occasionally by actual measurement of a number of plants.

Another good plan, where estimates for fair-sized areas are repeated at intervals, is to select a course over the area and follow it for each observation, in order that the same conditions will be covered each time.

In order that there may be uniformity between years and between observers, the examiner should make a written description of each class of utilization for each species, describing each class on basis of proportion or length of current year's growth left or in other suitable manner.

Palatability

A knowledge of the relative palatability of various plant species is necessary as a basis for carrying capacity and other phases of the problem. Consequently a palatability table should be built up for the more important species. Seasonal use is a factor and the data should be obtained for summer and winter use. The observation on summer range should be made incidental to other work.

The instructions on pages 44 and 45 of the RM section of the R-4 handbook will be helpful in making the palatability study. These instructions are for use chiefly where data is obtained on range at the time the range has been utilized to but not beyond the proper degree. For such conditions it will be helpful to use the following classification:

For ordinary use		For detailed use if necessary	
Description	Degree of Use (Per Cent)	Description	Degree of use (Per cent)
Choice	81 - 100	Extra choice	91 - 100
		Fairly choice	81 - 90
Good	61 - 80	Extra good	71 - 80
		Fairly good	61 - 70
Medium	41 - 60	High medium	51 - 60
		Low medium	41 - 50
Low	21 - 40	Moderately low	31 - 40
		Fairly low	21 - 30
Inferior	0 - 20	Fairly inferior	11 - 20
		Very inferior	0 - 10

Where there is not fairly complete utilization as on the summer range, or on lightly utilized winter range, it will be necessary to designate the palatability by the preference shown for the different species in a type. For this purpose the several classes, choice, good, medium, low and inferior, should be used without regard to the degree of utilization and the notes should indicate that the range is lightly used or whatever the case may be.

Estimates of palatability should be checked against the per cent of various types of food eaten as indicated by results of paunch analysis.

Mechanical Influences

Observations and notes should be made on the effect on the vegetation and soil, of trampling, formation of contour trails, etc.

Census and Distribution

This involves counts on number of deer on selected sections of the canyon at monthly intervals. The following places are suggested:

Range Creek
White's Creek
Grouse Creek
Cabin Creek
Bernard, Sheep or Brush Creek east of Crandall's Ranch, vicinity of Jones Ranch, and benches in vicinity of Camas Creek.

A definite area should be selected in each locality and count made on the same area each time.

Observations of distribution on other areas should be made when convenient.

Counts should be maintained on the deer pasture established in 1929 and on the larger area along river below White's Creek, to give information as to number of deer and utilization. The chief object of these two areas is to compare animal-days of use with degree of utilization. These counts should be carried out more intensively than the general census counts indicated above and should be made at as frequent intervals as opportunity affords. Intensive mapping of these two areas need not be done at this time but determining the acreage and general composition and density of forage on each will be desirable.

The census and distribution study should extend to the upper limits the deer are reaching or to the line of snow too deep for the deer. Temperature and snow conditions should be recorded at the time counts are made, and counts should be made after heavy storms to determine their influence on deer distribution.

Any information tending to show reasons back of concentration and when this occurs should be recorded.

During March a general census should be made to obtain an idea of the total deer in the herd. This will require some additional assistance. Final estimate of numbers will then be based on total observations.

Separate records should be kept in as many of the counts as possible of the number of does, fawns, bucks and when opportunity affords, of the proportion of yearlings.

Drift

General observations of drift should be made to determine as far as possible (1) the full extent of range occupied by the deer and drift routes during the winter, as well as during the time the deer come in in the fall and go out in the spring. (2) The summer range from which the deer come that winter on Middle Fork and main routes of drift between summer and winter range. A plan will be developed for cooperation of the three forests concerned in obtaining information on item two.

General Habits

Observations on habits and life history as given in the outlines supplied should be recorded insofar as possible.

Predatory Animals

Observations should be made to determine the number of predatory animals as indicated by the number or signs seen. Game kills should be noted as to number, location, class of deer, condition of deer, etc. As opportunity affords paunches or entire viscera of predatory animals should be preserved in formalin for study of foods and parasites. Any information on the number of predatory animals killed within the area occupied by the game herd will be valuable.

Other Game

As opportunity offers, observations on ranges of other game should be made, particularly of the mountain sheep and of factors influencing them, and the advisability of introducing elk.

Climatic Records

Regular precipitation and temperature records will be maintained at Crandall's Ranch. Maximum and minimum thermometers should be installed for frequent observation and records made of snow depth made at White's Creek R. S.

Photographs

A valuable collection of photographs can be built up and will serve as a permanent record as well as being a valuable addition to the Forest Service collection.

Paunch Collections

Paunch samples should be collected over the winter season as opportunity affords, for analysis by the Biological Survey in Washington. Advantage should be taken of natural kills to get these samples. A total of a dozen samples well distributed through the winter will be adequate. Opportunity of getting mountain sheep or goat paunches should not be overlooked.

Natural Revegetation Studies

Studies have already been started to determine the influence of deer grazing on the growth and maintenance of the more important forage species. Four enclosures have been constructed and several more are

planned. Additional ones should be put in as necessities require and time and material may permit. Each of these enclosures constitutes a sample plot on which the more important species are recorded and observations made from year to year as to vigor, amount of growth, degree of utilization and other life history. For each enclosure there should be either a similar sample plot or transect on grazed range. It will be advisable to establish additional sample plots or transects on grazed range. The man on the study will be in the best position to decide whether or not sample plots or transects should be used. Transects offer many advantages. Plots and transects should be well marked and described for future reference.

Plant Development Studies

Any opportunities should be taken advantage of to obtain plant development records in the spring.

Definite areas, preferably some one or several of the permanent sample plots and transects, should be used and plant development records obtained beginning with the time the snow goes off. See R-4 RM handbook for instructions on methods.

Report

Data should be compiled and a progress report prepared at the end of each winter of study.

Cooperation

Challis, Salmon and Payette National Forests in cooperation with Intermountain Forest and Range Experiment Station and Biological Survey.

Assignment

Ranger Arthur Buckingham.

Progress With Publications During the Year

Published Since Last Report

E. W. Nelson - Methods of studying shrubby plants in relation to grazing. Ecology, Vol. 11, No. 4, pp. 764-69.

S. B. Locke - The study of big game ranges. Ecology, Vol. II, No. 4, p. 770.

S. B. Locke - Water areas as a forest resource. Journal of Forestry, Vol. 28, No. 5.

C. L. Forsling, E. W. Nelson, L. F. Watts and George Stewart - (co-authors with others). Forest and range resources of Utah - their protection and use. Miscellaneous Department of Agriculture Publication, No. 90.

C. L. Forsling - (co-author with special Utah Flood Commission). Torrential floods in northern Utah - 1930. Utah State Agricultural Experiment Station Circular 92. January, 1931. 51 Pages.

F. G. Renner - Watershed snow surveys read the irrigation fate of the valley. Idaho Daily Statesman.

In Print

C. L. Forsling - Erosion on uncultivated lands in the Intermountain Region. Scientific Monthly.

C. L. Forsling - A study of the influence of plant cover on surface run-off and soil erosion in relation to grazing on the Wasatch Plateau in Utah. Department Technical Bulletin.

C. L. Forsling and W. A. Dayton - Artificial reseeding of western mountain range lands. Department of Agriculture Circular.

Accepted for Publication

L. F. Watts - Green gold for yellow. American Forests and Forest Life.

Accepted by Journal of American Society of Agronomy

George Stewart and C. L. Forsling - Surface run-off and erosion in relation to soil and plant cover on high grazing lands of central Utah.

In the Hands of the Editor

E. W. Nelson - The influence of precipitation and grazing upon black grama grass range. Department Bulletin.

Being Prepared

G. D. Pickford - The effect of past grazing practice and fires on the vegetation and grazing capacity of spring-fall range in Utah. For Journal of Ecology or other paper.

G. D. Pickford - Changes in range forage cover on spring-fall range in Utah. Article for National Woolgrower.

C. L. Forsling, G. W. Craddock, Jr., and W. A. Denecke, Jr. - Management of spring-fall range in relation to sheep production in southeastern Idaho. Department of Agriculture Bulletin.

R. W. Bailey and C. L. Forsling - (in cooperation with Utah State Agricultural College). Geological aspects of accelerated erosion.

F. G. Renner - Bibliography of range, livestock, and wild-life management on western ranges. Department of Agriculture Publication.

F. G. Renner - Erosion on the Boise River watershed as affected by various biotic and physiographic factors. Department of Agriculture Publication.

S. B. Locke and W. G. Mann - Forage studies on the Kaibab Deer Range. Progress Report.

To be Prepared During 1931

L. F. Watts - Growth of western yellow pine during twenty years following selective cutting. Journal of Forestry or other technical journal.

L. F. Watts - Growth in a virgin stand of western yellow pine in Idaho. Journal of Forestry or other technical journal.

L. F. Watts - An analytical study of forest fires in the Intermountain Region, 1921-1930. Progress Report.

George Stewart and G. D. Pickford - Spring-fall and winter range use in relation to some phases of range sheep production in Utah. Article for the Woolgrower.

George Stewart and F. G. Renner - A study of the influence of erosion on certain physical and chemical qualities of granitic soils of central Idaho. For a technical journal.

E. W. Nelson - The influence of annual variation in precipitation on the yield of range forage in parts of the Intermountain Region. Technical Bulletin.

A. R. Standing - (R-4 administrative project). A critical analysis of plant development observations on mountain range lands of the Intermountain Region.

Projects to be ready for compilation and analysis at close of 1931 Field Season

C. L. Forsling and Geo. W. Craddock, Jr. - A study of the influence of different degrees, frequencies and seasons of grazing and harvesting on the yield of range forage. Technical report on result of eight years of study.

E. W. Nelson - The affect of year to year variations in climate on the growth and development of important range plants in three climatic zones on the Wasatch Plateau of Utah.

E. W. Nelson - Fifteen years of plant succession in the revegetation of depleted mountain grazing lands on the Wasatch Plateau of Utah.

C. L. Forsling and George Stewart - The significance of cell sap characteristics in the study of range vegetation.

PART II

EXPERIMENTAL FORESTS AND NATURAL AREAS

Experimental Forests and Ranges

PART II

EXPERIMENTAL FORESTS AND NATURAL AREAS

Experimental Forests and Ranges

A committee, consisting of C. B. Morse, Assistant Regional Forester in charge of Forest Management, L. F. Watts of the Experiment Station, and W. B. Rice, Supervisor of the Payette National Forest, was designated at the Investigative Committee Meeting a year ago to make field examinations and report upon the selection of an experimental forest in western yellow pine. Mr. Watts made a number of field examinations during the summer and the entire committee then looked over areas on the Payette Forest in the Cascade working circle. It was hoped that a desirable experimental forest in western yellow pine could be located in the vicinity of Cascade on the Payette Forest. However, most of the desirable forest lands in this territory are in private ownership and a good deal of the best National Forest land either has already been cut-over or is tied up in the Cascade working circle which has been obligated to a timber operator. The best experimental forest chance in this locality is on Skunk Creek and some adjoining land on Clear Creek. This chance is not the most desirable but is being kept in mind as a possible selection. Another chance is to be found on Gallagher Creek, a tributary of the South Fork of the Payette River between Garden Valley and Lowman. This is ideal with the exception of transportation and marketing of logs. However, a good road will soon be built to very near the area and an opportunity will be afforded for disposing of timber cut. There are one or two additional opportunities in this same locality which will be examined further. It is expected that one of the areas will be selected definitely as an experimental forest for western yellow pine before the close of the field season of 1931.

Natural Areas

A committee, consisting of C. N. Woods, Assistant Regional Forester in charge of Operation, Ernest Winkler, Assistant Regional Forester in charge of Range Management, R. J. Becroft, of the Utah State Agricultural College, and C. L. Forsling of the Station, was designated early in 1930 to consider the selection of natural areas. The supervisor of each forest concerned was also consulted regarding areas on his forest. The committee made a preliminary field examination of several areas late in June, 1930. Additional areas were examined by individual members of the committee. So far this committee has given attention chiefly to natural range areas.

On account of the intensive demand for grazing land in the Intermountain Region it was decided that it would not be a desirable policy to set aside any very large areas of range land now being used. At the same time it is recognized that it is advisable to have some areas retained as nearly natural as possible in each of the important range types. The policy adopted by the committee, therefore, was when necessary to select areas five to ten acres in size where the range is now being used, and to fence these areas for natural area purposes. Where larger areas were

available, such as municipal watersheds, game preserves, or other areas closed to grazing were available and desirable, they would be set aside as experimental ranges on the forests. It is recognized that the smaller five to ten-acre areas will not be the most representative of natural conditions since, although grazing is eliminated, they might be subjected to unusual influx of rodents, etc., from nearby areas. However, experience has shown that areas even as small as an acre are free enough from unusual disturbances to be of great value as natural areas. The following five to ten-acre areas have been agreed upon and tentative selections made for most of them:

Powell N. F.	-	High plateau top, mixed grassland, chiefly fescue.
Dixie N. F.	-	High plateau, mixed grass type.
Fishlake N. F.	-	Festuca thurberi and associated species.
Fishlake N. F.	-	Foothill range, oak and sagebrush.
Manti N. F.	-	Foothill range, sagebrush type.
Manti N. F.	-	High mountain, aspen-weed, and elder range.
Manti N. F.	-	High mountain plateaus, mixed grassland, chiefly Agropyron dasystachyum.
Ashley N. F.	-	High mountain, tufted hairgrass meadows.
Uinta N. F.	-	Lower mountain slopes, mixed brush type, chiefly oak.
Uinta N. F.	-	Mountain summer range, Mertensia leonardi.
Cache N. F.	-	Intermediate elevation, mixed brush type in medium.sized aspen.
Cache N. F.	-	Low mountains, mixed brush type.
Sawtooth N. F.	-	Low mountains, blue bunch - wheatgrass type.
Payette N. F.	-	High mountain plateaus, fescue, wheatgrass, poa, bluegrass, hairgrass and sedges.
Lemhi N. F.	-	Mountain basin dry-land fescue type.

These areas will be fenced as fast as funds will permit. A number of them will be fenced in the spring of 1931 with funds made available through unemployment appropriations.

The following are larger areas not now grazed:

Wasatch N. F.	-	On Timpanogos Mountain 768 acres, varying from alpine fir-Engelmann spruce to aspen-Douglas fir types with extensive open grass lands.
Wasatch N. F.	-	One of City Creek, Parley's Canyon or Cottonwood, all of which are now closed to grazing and which extend from the foothills to 9,000 or 10,000 feet in elevation. Several thousand acres each, to be examined and selected.
Cache N. F.	-	Pocatello Division. Pocatello city watershed, all types and exposures from foothill bunchgrass land to aspen and Douglas fir types, approximately 4,000 acres in area.
Boise N. F.	-	Head of South Fork of Payette River from Trail Creek to head of river, at least a township in area, now closed for game and recreation purposes and will include all timber, brush and herbaceous plant types from western yellow pine to mountain summits on coarse granite type soil.
Teton N. F.	-	Mixed weed type on range now closed to grazing.

PART III

ADMINISTRATIVE SECTION

PART III

ADMINISTRATIVE SECTION

The administrative investigative work of Region 4 is now being formally correlated under a liaison committee with E. C. Sanford of the office of Forest Management as chairman and principal liaison officer (see Regional Forester AS-Supervision, R-4, letter Feb. 25, 1931) in accordance with All Service Project 7 of the Forester's Plan of Work for 1930. Other members of the committee are L. F. Watts of the Intermountain Station; T. G. Taylor, Professor of Forestry, Utah State Agricultural College; A. R. Standing of the branch of Range Management; and T. V. Pearson of the branch of Operation. This committee, except Pearson, was designated at the Investigative Committee Meeting held early in 1930 and has now been functioning one year.

First Report of Liaison Committee

The committee met on February 17, 1930, to review and discuss the sample plot work being carried on by the administrative force of the Region.

Forest Management

Reports received from the forests showed that work had been done on 193 plots, some of which, however, have not been completed. In 1929 work was done on 29 plots, this being a greater number than had been expected since fire, beetle control and beetle surveys took so much time of forest officers in 1929.

Methods of Cutting Plots

There are 82 of these plots altogether, 20 of them being in lodgepole pine, 44 in western yellow pine (includes 13 which have not been cut over), 8 in Engelmann spruce, 8 in Douglas fir, one in alpine fir, and one in aspen. The committee considered that there was a pretty good distribution by species and by forests except that there is a shortage in plots in lodgepole on the Targhee, Wasatch and Wyoming Forests where most of the cutting in this species is taking place.

Methods of Thinning Plots

Watts stated that he believes some plots were established on the Targhee Forest in 1928 and 1929 for which data have not been filed in the Regional Office and concerning which no report was received from the forest. This will be looked into by Forest Management.

Reports have been received of the establishment of 49 methods of thinning plots. Of these 24 are in lodgepole pine, 12 in Douglas fir, 4 in western yellow pine and 9 in aspen. It is considered that the principal thinning problems which we have are in lodgepole pine and Douglas fir stands and that hereafter methods of thinning plots should be directed to these species. It is considered that the Minidoka, Cache, Caribou, Targhee, Teton, and Wyoming Forests should all have some studies in methods of thinning in the lodgepole pine type.

Reproduction Plots

Forty-nine plots have been established to study effect of grazing on reproduction, of which 14 are located in the western yellow pine type, 10 in lodgepole pine, 8 in Engelmann spruce, 7 in aspen, 6 in alpine fir, two in white fir and two in Douglas fir. Five plots have also been established for the study of reproduction after logging, of which four are in western yellow pine and one in Douglas fir. It was suggested that more reproduction plots should be established and checked up on every five years to determine what is happening after cutting. It is suggested that additional plots be established within methods of cutting plots and methods of thinning plots, these reproduction plots being mil-acre in extent and distributed in various parts of the larger plots to the extent of probably four of the reproduction plots to each larger plot. This would give not only the number of young trees established but would also give their distribution.

Miscellaneous Plots

Two plots have been established, one on the Challis and one on the Lemhi to study the spread of mistletoe and its control by cutting. These have not progressed very far, the one on the Lemhi having been established in the fall of 1929.

One plot to study beetle infestation in lodgepole pine has been established on the Ashley and five plots to study brush disposal were put in on the Fishlake in 1929. It was considered that the Region should not strive to expand the administrative studies to take in a large number of projects but that the work should continue along the lines already taken up. These are the studying of methods of cutting, methods of thinning, and effect of grazing on reproduction. The only addition to this list recommended is that of establishing more plots for the study of reproduction after cutting.

Professor Taylor stated that it was the desire of the forestry department of the Utah State Agricultural College to establish a school forest on which each forestry student would spend one summer. On this school forest a number of timbered areas would be treated in various ways and many plots established on which intensive studies of methods of cutting, methods of thinning, reproduction and other phases of forestry would be intensively studied. The treatment on these various plots would be much more intensive than that being done by forest officers in administrative work and would probably be more intensive than most of the studies which are being carried on by the division of Research. In addition to these studies on the proposed school forest, which he thought should include at least 1,000 acres preferably on the Cache Forest, the students of the college could cooperate with forest officers in the establishment of other plots. These plots should be in Logan Canyon or somewhere in the vicinity of Logan where work can be done in a single day's trip from the college. Students he said would be available for the establishment of the plots and actual thinning or cutting operations upon them.

The recommendations of the committee are summarized as follows:

1. Continue sample plot work on much the same basis as at present, that is, confine work pretty much to methods of cutting, methods of thinning and reproduction plots to study the effect of grazing and to study the extent of reproduction being secured after cutting. Individual forest officers should continue to be given large latitude in following up their own problems.

2. Put in more reproduction plots in the permanent sample plots being established for other purposes. These reproduction plots should be examined every five years. It is suggested that four mil-acre plots distributed over the method of cutting or method of thinning permanent sample plots be put in to determine distribution as well as numbers of reproduction secured. Recommend that instructions in the handbook be amended to provide for the establishment of reproduction plots.

3. Assemble original sample plot data in Regional Office to be filed in safe. This will permit review at intervals to determine remeasurement to be made and will insure availability of the data for analysis. Request some forests to supply data on established plots which are not now on file.

4. Have additional methods of cutting plots established in lodgepole pine cutting areas on the Targhee, Wasatch and Wyoming Forests.

5. Place most of thinning plots in lodgepole pine and Douglas fir types.

6. See if there is not more opportunity to use grazing enclosures as plots on which to study effect of grazing on reproduction.

7. Cooperate with the forestry department of the Utah State Agricultural College in establishing plots of various kinds on the Cache Forest near Logan.

Range Management

Instructions on how to establish and report upon the various kinds of plots are contained in the Range Management section of the Region 4 Handbook. Forms for recording and analyzing data for all kinds of plots may be requisitioned from the Supply Depot. The Regional Office recommends and so states in the handbook that a map be kept by each ranger showing where he proposes to establish each plot and showing the locations of established plots. If a ranger sets about to establish a certain number of plots, it is the best plan for him to select tentative locations beforehand, considering the purposes the plots are to serve, places most urgently needing plots, number of plots to be established on a given area, etc. It may then be necessary to change the locations somewhat when the plots are actually established, but the chances of getting the plots in poor locations are lessened, and of getting them in the best locations are increased. A legend may be found in the handbook giving standard symbols for showing each kind of plot, both established and proposed.

It was the consensus of opinion of the committee that in carrying out the administrative plot work program, it is not a good policy to set up a definite number of plots to be established on each Ranger District, but rather to sell the need for the various plots to the field force and to bring about plot establishment as a result of conviction that plots are worth while and a desire to obtain the data the plots can supply. The Regional Office should cooperate by instructing wherever opportunity presents itself, by supplying adequate forms, etc., and by pointing out problems that can be solved by plots and help in the selection of proper sites where plots can give needed information. It is felt that when emphasis is placed on getting a definite number of plots established, the rangers do the work mostly to meet the requirements and little good accrues to themselves at least. Plots put in because the ranger wants them will be established better and will have more training value.

Grazing Enclosures

It will be noted from the table that there is now a total of 688 established enclosures in the Region, or an average of 5.17 for the 133 Ranger Districts, and that the forests say they need 459 more, or an average of 3.45 per Ranger District, which, when constructed, will make an average of 8.5 per Ranger District. This seems to be a reasonable number, but it is believed the construction of enclosures will very probably go on in a conservative way for a long time as problems they can answer or places that will have a special PR value will no doubt keep cropping up long after the present program proposed by the forests will have been carried out.

There should be an enclosure in each major type on each forest, in addition to adequate plots to answer special and important problems as to whether a certain important plant species can be replaced by another, what species are climax in certain locations, etc., and to satisfactorily fit into the PR program on each forest.

It does not seem practical to endeavor to have signs in or near the enclosures merely giving the number of enclosures, or stating that it is an enclosure. The ranger knows this already and it can have little if any interest or value for the public. There is need, however, for signs on enclosures so located that the public frequently visits them, stating the purpose of the enclosure and pointing out anything of value shown by the enclosure. The committee recommends the posting of more signs of this type.

Take-Down Enclosures

There are very few administrative take-down enclosures in the Region. There are places where these enclosures would have real value, such as for showing the effect of deferring the opening date a short period, or deferring the range until seed is matured, of overcoming injury to timber reproduction by preventing early and late grazing, etc. The office of Operation is willing to finance these enclosures so far as it is able to do so if real need for them can be shown. Ordinarily four board panels are constructed which are wired together at the corners so they can easily be removed when it is desired to throw the plot open for grazing. The committee recommends the construction of a number of these enclosures in addition to the regular permanently fenced type of enclosures.

Plant Development Record Plots

It will be noted from the table there are now 620 divisions in the Region on which plant development records are being kept, or an average of 4.66 per Ranger District. There is need for improvement in the manner of record-keeping on these plots. Often the trips at or near the time of seed maturity and at the close of the grazing season are neglected. It is very important that we learn when the average date of seed maturity is being reached in the various areas in order that our deferred and rotation plans might be better organized and our plans for obtaining seed production be not defeated by allowing the stock on the area a week or two too early. It may be that as the relationship of these plots to the surrounding area becomes better known, they will develop into stations where the rangers can go each year to see at what date the range will be ready for grazing or seed will be matured for that vicinity without riding farther or spending more time to cover the range as a whole.

We are now reaching the point where the data from these plots can be assembled, correlated and analyzed, and averages deducted. Examinations have shown that some of the rangers are not well enough posted on standards of vegetational readiness and should refer to the Botany Briefs, Range Reminders, the Range Management section of the D-4 Handbook, and Bulletin 1405 "Grazing Periods and Forage Production on the National Forests" by A. W. Sampson and Harry E. Malmsten, for additional information.

We should not be in a hurry to feel that these records have been kept long enough, or that this phase of administrative investigations has served its purpose. Let us make sure, however, that too much extra traveling is not done to obtain the records, that plots are not duplicating each other, that all needed plots are established, and that records of high standard are being obtained.

Quadrats

There are now 1,217 established administrative quadrats in the Region, or an average of 9.15 per Ranger District, and the Supervisors say they need 1,190 more, or an average of 8.95 per Ranger District, making a proposed total of about 18 quadrats per Ranger District.

The quadrat work in the Region thus far has shown numerous weaknesses, some of which are yet to be overcome and can be, some of which are being overcome, and some of which are of such nature they will always be present. The committee believes a limited program of quadrat work should be maintained for the present at least as it is not yet definitely known that quadrats are not "worth their salt", especially considering that they seem to have some training value, but it is not felt that they have shown enough value to warrant a large scale quadrat program. Every ranger should put in at least a few quadrats and certainly those now in should be re-charted. In the meantime further checks on the practicability of ranger quadrat work should be made.

It has been found that the stakes placed around some quadrats have sunk out of sight, making it difficult and sometimes impossible to locate the quadrats. On forests where creosoting is being done, it is recommended that lodgepole stakes be creosoted for use in quadrat work in place of the regular angle iron stakes.

Individual Species Plots

Not less than 20 of these have been established in the Region, probably considerably more. The new Form 438 will probably call for the number established, if not, the Supervisors will be asked to make a report next year.

These plots give promise of appealing well to the field men and of having value in showing what is happening to the plant cover on the ranges. There is nothing very technical or arduous in their establishment and they should give a pretty good check on what is happening to the important species studied.

Other Plot Work

Each year the rangers report on the degree of utilization on the various allotments on their districts. This does not mean much until it is known how the forage production for the year compares with the average or normal. Therefore, the rangers make an estimate of how much forage production is above or below average. Sometimes their estimates seem to be rather bad guesses, which might be expected. The Intermountain Forest and Range Experiment Station checks show great variation yearly, sometimes reaching 100 per cent more forage production one year as compared to another. Rarely do rangers get farther than 10 or 15 per cent each side of normal, seeming to show their estimates are not correct. Now, could plots be selected in sites typical of surrounding range where the ranger could go each year to get height growth, or even to cut the forage at a certain height and get the green and dry weight, in order to have a better basis for estimating variation in forage growth? Could this be worked out so it could be done in a practical way? Would it have much value? This seems worth considerable thought. There may be other kinds of plot work the rangers might do to advantage.

Correlation of Plot Work

The committee discussed the probability of saving time and getting more work done by correlation of plot work, e. g. - some enclosures may be so located they will give information on timber reproduction and answer some question on forage plant succession at the same time. Such correlation is, of course, desirable wherever it can be worked out to advantage.

Plot Work for the U. S. A. C. to do

Professor Taylor was especially interested in finding a way his students can fit into the plot establishment program. The committee felt that anything the school can do in the way of establishing plots or making studies either on or off the forests would be a valuable supplement to the work the Forest Service is doing. It was suggested that the forestry students establish enclosures, quadrats, plant development plots, etc., on the spring range along the Logan foothills off the forest and also on the spring cattle range on the north side of Logan Canyon within the forest as a means of training for the boys and also to obtain information that might be of value. It may be that Supervisor Arentson will be willing to let the boys thin some of the stands of timber in Logan Canyon or Green Canyon under the direction of members of his force or the instructors in forestry as a means of training for the men, as a way of accomplishing thinning and as a means of obtaining pole material at a low cost for enclosure construction.

SUMMARY OF ADMINISTRATIVE PLOTS
(Data from Form 438)

Forest	Enclosures Now Established	Enclosures Still Needed	Quadrats Now Charted	Quadrats Still Needed	Division on Which Plant Development Records Kept
Ashley	27	7	53	67	26
Dixie	38	26	60	80	31
Fishlake	82	44	58	114	36
LaSal	34	0	22	28	10
Manti	43	27	50	86	22
Powell	59	8	110	27	34
Uinta	47	24	120	30	24
Wasatch	27	21	30	64	17
Kaibab	41	9	60	17	2
Humboldt	21	37	33	103	36
Toyabe	8	11	45	41	27
Nevada	29	8	103	32	33
Boise	7	7	17	13	29
Cache	23	20	21	36	39
Caribou	15	8	20	33	29
Challis	23	14	9	31	14
Idaho	5	14	25	24	13
Lemhi	12	11	26	26	25
Minidoka	13	13	24	29	26
Payette	9	6	18	15	13
Salmon	29	6	26	46	35
Sawtooth	39	61	148	102	5
Targhee	13	16	39	14	45
Weiser	16	36	36	43	22
Teton	12	7	15	19	13
Wyoming	16	18	49	70	14
Totals	688	459	1217	1190	620
Avg. per Rngr. Dist.	5.17	3.45	9.15	8.95	4.66

Progress in Administrative Projects During 1930

Forest Management - Administrative Projects

1930 - 1931

General Status

Reports have been received from twenty-four of the forests up to the present time showing the FM investigative work done in 1930 and the projects on which it is proposed to work in 1931. The Lemhi and Minidoka have not yet been heard from. There was very good progress made in administrative studies work in 1930, twelve forests having worked on thirty-three plots or projects. Twelve forests reported no work done in 1930. In several cases no work was done on account of the press of other work which caused investigative work to be pushed into the background. In many cases insect control work was the cause of postponement. This was particularly the case on the Cache, Caribou, Targhee, Teton, and Wyoming Forests where the entire personnel was engaged in insect control work during the months of May and June and several of the men were busy for a considerable part of September, October and November on insect surveys and control work. Other forests which detailed men to these insect control jobs often had to postpone administrative and other work which had to be caught up as far as practicable during the remainder of the field season. While not in direct conflict with investigative work at the time insect control work was under way, there was frequently interference with plans which ultimately resulted in postponement or failure to do planned sample plot or other investigative work.

During the early part of the winter Mr. Watts reviewed the sample plot data in the Regional Office files and made a number of suggestions which have been passed on to the forests. In many cases these suggestions were for the writing up of a more complete history of plots and the work done on them while in other cases they were for the establishment of reproduction plots or transects or for the early completion of cutting work or for remeasurement at the time cutting is completed.

Scope of Projects

It has been the policy to stick pretty close to studies in methods of cutting, methods of thinning, and reproduction. The reproduction studies include effects of grazing by deer, elk, cattle and sheep on reproduction and also the reproduction secured after cutting. It has, however, been the policy to encourage work on any project in which any individual was particularly interested. This has resulted in broadening the scope of the work so that we now have a number of plots established for the study of mistletoe, beetle damage, and brush disposal in addition to those in cutting, thinning, and reproduction. While a number of plots have been abandoned for various reasons, there are now, in addition to many sample marking plots, 213 established plots. These include 92 method of cutting, 42 method of thinning, 66 reproduction, three mistletoe, nine brush disposal, and one beetle damage plots.

Work Proposed for 1931

The 24 forests so far reporting have proposed work on 66 plots in 1931. This includes the remeasurement of 24 plots, the establishment of 14 methods of cutting, 16 methods of thinning, four reproduction, three brush disposal, one mistletoe, one beetle damage, and one check plot, and the location of suitable places for two other plots.

The Intermountain Forest and Range Experiment Station is selecting a number of the plots already established and it is understood that it is the intention to build up a more complete record on these and to establish others in the vicinity to give a complete picture of what is going on in the type to which they are applicable. It is the plan to have Mr. Sanford accompany Mr. Watts on a trip to the Weiser and Idaho Forests in September in order to get better correlation of the studies work between the Intermountain Station and the Regional organization. Better instructions will then be incorporated in the handbook concerning the establishment of the different plots. This is particularly necessary with reference to reproduction plots since no definite instructions have been issued concerning them.

It is planned during the coming season to go over the old cut-over areas on Black's Fork to ascertain the condition of brush left from these early lodgepole tie cuttings and also to note the density of reproduction which is being secured on these cut-over areas.

Additional Work Needed

It is proposed to carry on the administrative studies work in accordance with the committee report of last spring. From time to time it will be necessary to make some slight changes and to issue instructions to bring about more uniformity in methods of handling the work on the different forests. The following things appear to be required at the present time:

1. Better instructions in the handbook concerning the establishment of the different types of plots.
2. Renumbering of plots on some forests to eliminate confusion.
3. Establish more check plots.
4. Continue projects with the idea of rounding out a complete set of plots in each major forest type.
5. Arrange for working up and analyzing data from plots as many of them are now coming up for remeasurement.
6. Have study projects incorporated in forest work plans.

Summary

The following tabulation shows the present status of administrative plot work in the Region:

STATUS OF FM ADMINISTRATIVE INVESTIGATION WORK - 1/30/31

Forest	Purpose of Plot									Plans for 1931
	Mc	Mt	Mr	Effect of grazing on reprod.	Mistle-toe	Reprod. after cutting	Beetle damage	Sample marking	Brush dis-posal	
										1 thinning and demonstration plot in L.P.
Ashley	7	-	2	4	-	-	1	-	-	Vernal-Manila road.
Boise	2	4	-	2	-	-	-	-	-	1 sample marking plot; 1 beetle damage plot.
Cache	2	-	-	6	-	-	-	-	-	
Caribou	-	3	-	1	-	-	-	-	-	1 check plot L.P.; 1 reprod. plot; 2 different intensities of thinning in L. P.
Challis	-	-	-	-	1	1	-	-	-	2 thinnings L.P.; 1 reprod. L.P. in clear cut areas; 1 mistletoe; 1 rate of growth D.F.; 2 sample marking in D.F.
Dixie	6	-	-	4	-	-	-	-	-	
Fishlake	3	-	-	18	-	-	-	-	5	
Humboldt	Plots ruined by insects - limber pine and white fir									
Idaho	12	-	-	-	-	-	-	-	-	3 remeasure; 3 Mc plots.
Kaibab	1	-	-	-	-	-	-	-	-	2 Mc
La Sal	-	-	-	-	1	-	-	-	-	2 Mc, 2 Mt; 2 Mr
Manti	17	(4 abandoned)		2	-	-	-	-	-	3 remeasurements; help needed.
Nevada	-	-	-	-	-	-	-	-	-	
Payette	9	1	-	2	-	-	-	-	-	5 remeasurements
Powell	8	-	-	8	-	-	-	-	-	2 Mc in Y. P.
Salmon	2	3	-	-	-	-	-	-	-	1 D. F.; 1 remeasurement Y. P.
Sawtooth										Have 22 plots set up; start in 1931.
Targhee	3	5	-	-	-	-	-	-	-	6 Mt plots L. P.
Teton	-	4	-	-	-	-	-	-	-	1 L. P.Mc complete; 2 D. F. thinning
Toyabe	-	-	-	5	-	-	-	-	-	
Uinta	3	-	-	2	-	-	-	-	-	2 remeasurement; 2 located; 2 Mc establish
Wasatch	3	-	-	1	-	-	-	-	4	2 Mc to remeasure; 3 complete work on 3 brush disposal plots; 4 Mc complete.
Weiser	4	1	-	-	-	4	-	-	-	1 Mc, 1 Mt, select locations for 2 plots in
Wyoming	9	3	-	-	-	-	-	-	-	7 remeasurements /Brownlee district/
Totals	91	24	2	55	2	5	1	-	9	
#Lemhi	1	10	-	-	1	-	-	-	-	
#Minidoka	-	8	-	4	-	-	-	-	-	
Grand Total	92	42	2	59	3	5	1	-	9	

#No reports of work done in 1930 or proposed for 1931.

Range Management - Administrative Projects

1930 - 1931

Work on plant collections, palatability studies for both domestic stock and game, experimental enclosure construction, quadrat and species plot charting, and plant development studies was continued during 1930 by the field force. A number of fenced enclosures have been constructed to determine the effect of game grazing upon the range. Some of these enclosures have fences that exclude domestic stock but not game, while others exclude both domestic stock and game.

Fish and game work has been transferred to the office of Range Management and former Supervisor O. A. Olsen has been assigned to the office of Range Management to aid in handling fish and game work. A large part of his time for several years to come will be devoted to game counts, studies of distribution, foraging habits, trends in numbers, etc. and the development of game plans. Increased activity on the part of all the field administrative personnel in work of this nature is expected in the future, and, in fact, has already begun.

All the data that have been obtained throughout the Region from plant development studies to date are being compiled for analysis on the calculating machine at the Washington Office. When this analysis is completed, conclusions will be drawn, if possible, on the most reliable plant indicators of vegetational readiness and the degree of development of each at vegetational readiness, average dates of vegetational readiness and seed maturity by elevational zones, plant types, exposures, groups of forests or individual forests, etc., variations in seasons from year to year, and so forth.

The volume-palatability study has been carried forward and the data obtained to date partially analyzed. It appears the volume-palatability method of doing grazing survey work is feasible and practical to apply by the methods being worked out in Region 4. More field studies are needed, however, before complete and accurate enough data will be available for actual use of the method.

Work for 1931 will be along the same general lines pursued in 1930.

A summary of plots and quadrats in the Region follows:

Observation Plots, Including Plant Development Stations

Fenced		Unfenced	
Total to Date	Needed	Total to Date	Needed
671	377	870	403

Quadrats and Species Plots

Fenced		Unfenced	
Total to Date	Needed	Total to Date	Needed
428	447	990	1040

Operation - Administrative Projects

1930 - 1931

1. Lightning Storm Study. This is a part of the RS-Pf, R-1 project inaugurated by the Forester in 1923. Prior to this year Region 4 has collected the Lightning Storm Reports secured by the various primary lookouts and has forwarded the material to the Washington Office for abstracting, coding and analysis. Beginning this year the abstracting and coding work is being handled by the Region under the supervision of the Intermountain Forest and Range Experiment Station. The analysis of the data will be by Mr. Gisborne as heretofore.

2. Statistical analysis of past fires. RS-Pf, R-1. In order that the maximum amount of benefit may be secured from the past ten-year fire record and history in the Region, we are cooperating with the Intermountain Forest and Range Experiment Station in an analysis of the individual fires on the eight so-called fire forests for the years 1921 to 1930 inclusive. We are abstracting and coding the fire report data in accordance with the scheme worked out for a similar project being carried on in Regions 1 and 6. There will be between 3,500 and 4,000 fires to handle. The Experiment Station has taken the responsibility for directing and supervising the work and for the final analysis of the data. Region 4 is providing the man-power to abstract and code the material and will share with the Experiment Station the expense incident to the analysis. Two men were assigned to this project by the Region on January 1 and not less than five man-months will be required to complete the work of abstracting and coding the data. Final analysis will not be undertaken until the winter of 1931-32, at which time a much better idea as to the needs for the transportation study will be had.

3. Fire Weather. This Region is cooperating with the Director of the Boise Weather Bureau Station in some study on the measurement of forest fire danger. Complete meteorological equipment has been provided for several of our lookout points, and a few duff hygrometers have been purchased for the use of the Weather Bureau in starting work along this line.

4. We are getting from each forest ranger in Region 4 Forms 26 by months for the peak season of 1930, in order to get a good view of activities on which time is being spent by rangers. This is in connection with our annual allotment estimate work. Our allotment conferences will not be finished until early in March, so we cannot analyze this data until later.

5. We are continuing the study begun by Assistant Regional Forester Parkinson on inspection time of Regional Office overhead, and are getting similar data for each inspector from the forest overhead for the season of 1930 to assist in the plan.

6. Mr. Pearson visited the Regional Office in Missoula early in the winter to gain as much as possible of first-hand knowledge of central purchase activities as they are conducted. This has been followed up by a detailed study of our R-4 purchasing done during fiscal year 1930, with a view to determining our annual needs and savings that might be effected by setting up a central purchase scheme in this Region. This study is still in progress.

7. Mr. Thompson and Mr. Pearson, in cooperation with a local motorcycle expert, have conducted some investigations and field tests to determine the utility of motorcycles for travel on mountain roads and trails, particularly for quick dispatch of limited numbers of men to extinguish fires while they are small.

8. Mr. Pearson has devised an R-4 type of fire finder (cost about $14.00), which we are using in place of the Osborne fire finder (cost about $90.00). The idea here has been to save costs for this class of equipment without particularly reducing efficiency.

9. Mr. Shank initiated a visibility study on the Challis and Salmon National Forests during the summer of 1930. The purpose of the survey was to determine areas (1) of direct visibility, (2) of indirect visibility, and (3) unseen areas from each of seven lookouts individually and as a group by field sketch methods and a comparison with the result from a relief model based on good quality U.S.G.S. topographic sheets. The seen and unseen areas were determined by light and shadow methods. The total area studied was 1,160 square miles. Field sketches revealed that 45.0 per cent was seen from the lookout system. A relief map built of the same area revealed 45.7 per cent of the area to be seen from the lookout system. In view of the results gained in 1930, Mr. Shank has recommended that a plan or program be initiated next field season to make a complete visibility survey by field methods of the central Idaho group of fire forests, beginning with areas of greatest hazard as far as is practicable.

10. We should undertake as soon as practicable a study of fire damage in the various forest types of the Region. We are not yet prepared to say just how this study should be conducted and this will be one of the things to be worked out as the study assumes more definite form.

11. Projects Nos. 1 and 3 will be continued for a good number of years, or until most practicable results are secured. Project No. 2 probably will be completed during the winter of 1931 and 1932, producing results which we feel will be valuable. Project No. 6 will be completed within a month or so, and indications are that this study will result in application of the central purchase idea in Region 4. Project No. 7 will be continued during the coming summer and will probably result in the placement of one motorcycle in fire protection work on the Payette National Forest. Project No. 9 will be continued several years, or until the central Idaho fire forests are covered. Project No. 10 will probably be conducted over a number of years to get usable results.